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ABSTRACT

This paper examines the implementation of computer technologies in schools across Canada, focusing on the problem of managing change. The first section discusses what policy is and how policy is made in a global age. The second section addresses policy convergence, i.e., new, harmonized policy alignments brought on by the communications revolution, and the global economic changes in which it is occurring. The third section describes some of the key initiatives in Canada, including federally funded programs, as well as programs in Nova Scotia, New Brunswick, Ontario, Manitoba, and British Columbia. The conclusion proposes the following four recommendations for progressive policy development: the articulation of a plan or coordinating vision; the development of transparent policy processes; a value-added approach to technological implementation that relies on research rather than hype; and a reward system acknowledging experimentation and innovation. (Contains 25 references.) (MES)

Is Policy Important? Technology Policy and its Practices in K-12 Education in Canada

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For the last year our research group has been examining the implementation of computer technologies in schools across Canada, focusing on the problem of managing change within what we see as a transitional period in education.

We have identified and clarified some of the more pressing questions arising from the implementation of computer-based technologies. These questions include: technological, infrastructure, human resource and learning policy issues; questions of sustainability; and questions of public policy in an increasingly technocentric and commercial education environment.

Each of these issues speaks to the need for strategies designed to address how and why choices are made, who makes them, and to what effect, both intended and unintended. Too often the reverse happens: technology changes rapidly and decisions are made in a more or less ad hoc fashion, as administrators scramble in response to the initial promises of technology. And then these same administrators, as well as teachers, students and parents, must face unforeseen problems and demands triggered by its implementation. The cart drives the horse.

There is a critical need for an approach to the implementation of technology in our schools that pays attention to questions of policy, organizational culture, politics, and decision-making practices (Allen, 1992; Apple, 1986; Apple & Jungck, 1998; Bryson & de Castell, 1996; Goodson, Manga & Rhea, 1991; Rossman, Corbett & Firestone, 1988; Peea, 1991). That is the approach we have taken in our work.

What is Policy and How is Policy Made in a Global Age?

Policy is the set of written and unwritten rules and guidelines which institutionalize and put into operational form a social contract. Policy is at work in both macro and micro levels of governance and control: in government at all levels, in universities, in schools, and in all other institutions. Policy addresses both procedures and goals, directly and indirectly. Policy provides a framework for a structure of decision making, and it rationalizes the decision-making process in the context of substantive and idealized value sets.

In its progressive roles, policy will be flexible and will map and steer change in light of evolving social perspectives and goals. In its conservative roles, policy tends to entrench institutional practices and power relations against change.

Dysfunctional policy tends to deny the reality of policy as an historical artifact, as the operational form of evolving social and institutional relations. Policy breakdowns can occur at both ends of the spectrum. A conservative policy is dysfunctional when it is used to defend bad decisions on procedural grounds, when it is used to bolster an institution and its powers against beneficial change and evolution, when it is exclusionary or non-inclusive. A progressive policy will be dysfunctional if it is too far out front, if it is uninformed, short-sighted, pressure-group driven and non-inclusive.

Policies addressing the information revolution are largely meant to be progressive policies by their implementers—that is, they are intended to map, steer and facilitate institutional change in light of the promise of a technological revolution. They are often "out-front" policies, leading change.

According to Ernest Wilson (1997) policy development typically proceeds in distinct phases. In a first phase, technical issues are propelled into public view and onto the action agenda of senior policymakers. Policy is then developed in consort with the implementers, who explain the cutting-edge features of their work, and the social problems it will solve.

Only in a subsequent phase are more critical issues engaged: the institutional, political and power distribution issues; the question of winners and losers and how a balance can be achieved among them.

The best progressive policy is based on research, and is based on informed and inclusive debate. Our work demonstrates, however, that we are largely stuck in the initial phase of policy development as defined by Wilson—important policy decisions are being made in a largely ad hoc manner, driven by action-oriented bureaucrats and technology promoters. And this seems to be true of information policy generally around the world.

Policy Convergence

As Brian Lewis (1997) has written, on a global scale we now seem to be faced with a phenomenon which can be called "policy convergence": new, harmonised policy alignments brought on by the communications revolution, and the global economic changes in which it is occurring. Nation states themselves are less relevant. National value systems seem more archaic. The protections of time, space and cultural uniqueness seem to be washed away.

Most countries are greeting the emerging communication technologies with new sets of globally harmonized regulatory and economic policies. In the formulation of these policies, they are facing the simultaneous turmoil induced by a series of related fundamental global trends: worldwide policy deregulation in telecommunications, the collapse of traditional national market barriers, economic concentration in truly transnational companies, and breathtaking technological innovation, as communication technologies converge into a digital sea.

As we are entering a new age of information, so we are entering a new age of policy. Quickly and surely, policies are converging. The policy maker's job has switched from policing to promoting. If the role of the policy maker in the past has been to moderate market forces in light

of national, regional or local goals, the role now is switching, to the moderation of these goals in light of new global economic and technological imperatives: competitiveness, convergence, globalization, interoperability. The social context, the values which have guided public policy, have greatly diminished in importance.

This leads to profound questions about the role and nature of policy itself as a mechanism of controlled evolution. Are the old cultural and economic values attainable—or even desirable—anymore? Policy makers everywhere have begun to find the traditional policy contexts inadequate, indeed irrelevant, to their work.

In Canada, among other countries, policy-makers have largely shifted their focus away from cultural protection and protection of the public good in any traditional sense. The Canadian government's commitment to a globally-oriented, privately-developed, market-based regulatory framework has thrown into question the nationalistic communications policy framework of the past several decades. As a new communications infrastructure is being established, an entirely new policy framework is developing as well.

In justifying their policies, governments have employed idealistic and simplistic visions of what the information revolution will mean. In their rush to remain competitive with the United States and the rest of the world, few policy makers are asking truly fundamental social questions about the risks and the changes societies may be rushing into. Essentially we have embarked on a world-wide game of chicken. Policy convergence has followed fast upon technological convergence in the race to keep up with the United States.

The "education revolution" is a small but critically important part of a more general information revolution—one front in a larger campaign. In this micro realm we find the same transformation of policy. Policies addressing the implementation and use of new technologies within education find themselves firmly entangled within overall information and economic strategies. Increasingly, education policies find themselves straddling boundaries between educational and economic objectives, even subordinate to them. The "ivory tower," if it ever existed, exists no more.

In fact, it is as if a major social fault line has shifted: there has been a shift in our relationship to almost all social activity—which seems increasingly judged and evaluated against a touchstone of economic objectives and priorities. Education has not escaped this shift. If education had once been an objective, a goal, a final cause, for many of its leaders, movers and funders, it has now become much more purely a means to the end of a more efficient and competitive economy and workforce, captured within the notion of the "knowledge economy."

Canadian public policy in all areas has become concerned with the country's transition to a "knowledge society" (Information Highway Advisory Council, 1995). This transition has brought increased attention to education, which is considered to be a primary engine and infrastructure of the "knowledge economy." One result of this shift has been an added emphasis on information technology in our schools.

The past few years have seen an extraordinary amount of interest and investment in the deployment and use of computers and computer networking in Canadian public schools. A few examples: the 1998 federal budget committed $205 million over three years to Industry Canada's "Community Access Program" and "SchoolNet," to promote the use of information technologies in schools and libraries. The province of British Columbia committed $100 million between 1995 and 2000 toward computer hardware, software and teacher training, and in 1998 it announced an additional investment of $123 million over 6 years for development of a network to link the province's public schools, colleges and institutes. The Province of Quebec announced a commitment of $318 million for computers in schools over a five-year period in 1995 (with no money for teacher training!).

These kinds of "investments" are repeated throughout Canada, from Newfoundland to Nunavut. Governments at all levels have made ambitious promises about equipping classrooms with computers, and have devoted significant funds toward fulfilling objectives including the promotion of computer skills, networking students around the country and the world, and implementing courses through distance education. And yet, all of these investments have come in what is inarguably a period of relative financial stress for publicly-funded schools. Important, "leading-edge" policy decisions indeed!

From Sea to Sea: Computers in Canadian Schools

Our research focuses on the policies currently in place at the national, provincial and school board levels for the implementation of computer technologies in K-12 education. We have employed several methodologies in our work, from documentary research to site visits and interviewing, to participatory interventions. Because technology-mediated learning in K-12 education is changing rapidly, we did not use a traditional sampling methodology for our case studies. A traditional sampling approach often misses the direction and velocity of change. Instead, we used a type of non-representative sampling to target early-adopters of educational technology. This type of research is well-known in studies of the diffusion of innovation (Rogers, 1981) and has more recently been applied to technology and market opportunities (Bailetti and Guild, 1991; Smith, 1995).

Once we select a site for a field visit, we conduct an in-depth "vertical" analysis of all aspects of the school's use of technologies and the policy processes that supported or hindered it. Through observations and semi-structured interviews with provincial officials, administrators, and teachers, we have begun to identify a common range of issues that have been encountered by schools and school boards that are not yet addressed in policy, or that are currently hindered by policy generally.

Below are some of the key initiatives we have looked at, presented briefly in this paper because they foreground some of the important policy issues in the "education revolution."

Federally-Funded Programs

Education in Canada is a provincial responsibility. There is no Department of Education within the Government of Canada. There are, however, key federal policies and several key federally-funded programs which have been and will continue to be driving motors for much of the

technological investment in Canadian Schools. These programs are contained within the government of Canada's "Connecting Canadians" initiative, which is administered not by a department of education or culture, but rather by Industry Canada.

The mandate of "Connecting Canadians" has been to "connect Canadians to each other and the world" –something it claims to have accomplished by March 30, 1999, making Canada "the first country in the world to connect its public schools, including First Nations schools, and public libraries to the Information Highway" (SchoolNet, 2000).

Funding from the Connecting Canadians program goes to two sub-groups which have direct impact on schools: the Community Access Program and SchoolNet. The Community Access Program provides funding for infrastructure, hardware and software to facilitate public access to the Internet through schools, libraries, and community centres.

Within SchoolNet, two programs are especially important sources of funding for schools: GrassRoots and Computers for Schools. GrassRoots funding supports on-line projects developed by teachers and their students to build Canadian content, at the same time developing "the skills young Canadians need in the knowledge-based economy." It provides a range of funding opportunities from $300, $600 and $900, up to $5,000. The Computers for Schools program donates surplus or used computer equipment to schools and public libraries across Canada, in conjunction with private partners.

The federal approach through Industry Canada is clearly an approach which values infrastructure, equipment and connections as ends in themselves. Canada and its institutions must be wired to "play a part in the global knowledge economy." Initiatives dealing with content, curriculum development, and teacher support are secondary. A bias toward infrastructure development is one found at all levels of government. Machines are easy to "understand."

Nova Scotia

Nova Scotia has pretty much bought into the Industry Canada vision of things. In 1998, the government of Nova Scotia implemented the 3-year "Information Economy Initiative," with the assistance of Industry Canada. This was a unique, $73.4 million federal-provincial education partnership, sold as an economic development, skills-building project. Of the $73.4 million, the Department of Education received $38.2 million for the purchase of over 6,000 computers and LANs and Internet connections for junior and senior high schools.

Substantial funds were targeted to professional development for teachers, through programs handled at the school board level, and to support technical personnel. Tellingly, elementary schools were not able to participate in this program as it was meant to focus on skills-training, rather than more general educational or curricular objectives.

Now, as the three-year cycle ends, important questions are being raised about the sustainability of any such one-off program: how does one assure continuing upgrades to the skills sets of the teachers; indeed, how does one maintain the infrastructure itself?

A new strategy for technology in schools is articulated in a 1999 document, "Vision for the Integration of Information Technologies" (Nova Scotia Education and Culture, 1999). This vision calls for the integration and implementation of information technology (IT) throughout the public school system: "the educational use of IT best improves learning when those technologies are accessible, flexible, responsive, participatory and integrated thoroughly into all public school programs" (Nova Scotia Education and Culture, 1999). It specifies IT-related learning outcomes for students based on grade level. This represents a significant departure from what we have been able to see so far, and the question of how it would be funded is an obvious one.

New Brunswick

New Brunswick is another interesting case: if anything the province has pushed the conflation of education policy with economic policy even farther than the federal government. As we have argued elsewhere, "What distinguishes New Brunswick's approach is its intent to create an education industry as the central element in its economic plan for a transition to the knowledge economy. For this reason, telelearning in New Brunswick is designed as an economic development strategy first, and an education strategy second" (Lewis, Massey & Smith, 2001).

Essential to the support and implementation of all information technologies in New Brunswick's public school system is the Information Systems Services Branch of the Ministry of Education. It leases thousands of computers to schools, manages administrative computing systems, LANs and WANs, which connect all schools, district offices and the Ministry, and supplies every principal in the province with a computer to aid with administrative tasks. The Branch has also collaborated with the Curriculum Branch and District Supervisors of Technology and Learning to co-develop the "Mentor Teacher Program."

In a report entitled "A Framework for Technology Education for New Brunswick," (New Brunswick Department of Education, 1999) the province outlines a vision emphasizing technology integration into the curriculum and creating a "balance" between literacy, math, science and technology. Specific technology learning outcomes are addressed in a "Technology Education Foundation" document which is still under development.

New Brunswick stands out among the provinces in its commitment to the development and delivery of distance education programs. One of the more interesting initiatives the province has implemented is a sales tax rebate of $500 on the purchase of a home computer.

Ontario

Ontario is Canada's largest, most populous and wealthiest province, and the centre of Canada's major education faculties. It has not, for all that, been in the forefront of technology implementation. Here, policy has tended to be more conservative, perhaps because of a heavily market-force oriented provincial government, and the distractions of large-scale structural educational reform.

While new initiatives and funding for technology have been relatively haphazard and insignificant up until about 1999, Ontario now seems poised for major changes. A 1999 initiative

committed $130 million for Internet connections and other large networks for classrooms, schools and school boards. Funds are now provided on a per-student basis to school boards for the purchase of hardware and software. The government also funds a number of narrowly targeted on-line service programs, including "Snow" (a resource web site for teachers of students with special needs), P.E.B.B.L.E.S.("Providing Education by Bringing Learning Environments to Students" connects students in hospitals or other locations to their classrooms), and SPECTRUM (supplies math, technology and early childhood education material on-line).

An important new report, which is expected to lead to major and dramatic investments in technology in this schools, will be published this year, after extensive consultation. Interestingly, the committee developing this report includes respected academics and researchers knowledgeable about the pedagogical and administrative issues often overlooked by the government policy-makers. It remains to be seen whether Ontario (like British Columbia, described below) will be able to profit from their experience, and the experience of earlier, less successful initiatives elsewhere.

Manitoba

A large prairie province, Manitoba seems to be carving out a niche for itself in several ways.

It is targeting much of its spending toward the development on on-line curricular materials for teachers and students. On-line projects in the province are significant, and seem to be funded both to support the province's broad mandate of developing technology literacy, and as a mechanism for professional development and raising the skill-sets of participating teachers. Funding for on-line projects include the "Curriculum Information Technology Integration Project," designed to help teachers integrate technology into the curriculum by building electronic resources useful to each other, the "Interdisciplinary Middle Years Multimedia Project" grants, and the "Web-based Course Research and Development Project."

Significantly, the Ministry of Education has committed $81 million for professional development in information technology and distance learning. The document "Technology as Foundation Skill Area" outlines a vision for the integration of information technology throughout the curriculum and across all grade levels (Manitoba Education and Training, 1998).

Manitoba is also involved in supporting school and business partnerships through the Manitoba Education Research and Learning Information Networks (M.E.R.L.I.N.). M.E.R.L.I.N. provides links between businesses and schools as they work to build technological infrastructure. It helps the schools develop strategic plans for purchasing computers and applications, holds software licenses for the province, negotiates Internet access, and oversees the implementation of networks for distance education.

British Columbia

As the political scene in British Columbia sometimes seems fractured, so too have policies around educational technology and its use over the past six years.

The recent development of a new more strategic approach to technology in the schools may, however, be an interesting model for future practice.

British Columbia is currently in the process of revisiting and extending initiatives it began to establish in 1995 when two key reports were published, the "Provincial Information and Computer Technology Plan" (PACET, 1995) and the "Technology in British Columbia Schools: Report and Action Plan 1995-2000." (Technology and Distance Education Branch, 1995). From the latter came the District Technology Grant Program, which provided $100 million over the five-year period for technology spending, divided among all districts in the province, and dependent upon the submission of a technology plan. Another significant early initiative was the Provincial Learning Network (PLNet) which provided $126 million for wiring all schools and districts. (The PLNet web site claims to have delivered on this promise, although in our interviews we have discovered that "connection" can mean something very different for each school—some schools have Internet connections in each classroom, which other schools have only one connection in the school office, or are using a modem to connect a entire lab). In total, over the last five years, British Columbia has committed over $200 million to the development of infrastructure for networks and for the purchase of hardware and software by its schools.

In 1999, a Teaching Learning and Education Technology Advisory Committee was formed consisting of teachers and interested computer educators and politicians. The Committee's report, "Conditions for Success," (June 1999) attempted to comprehensively identify key issues or themes for technology use, and this, interestingly, from the educators' perspective: in addition to curriculum development and output questions, we find themes such as meaningful and integrated technology learning for students; professional development and support for teachers; equity; involvement of all teachers in decision-making processes, not just "enthusiasts"; research for policies and programs; and adequate funding.

The Ministry has produced a draft document, "Information and Communication Technology—A Plan for 2000 and Beyond" which is based on the committee's report, but which has not yet been implemented as policy. This draft document does, however, seem to take the recommendations of the committee seriously, and outlines provincial commitments to its major objectives.

The "Conditions for Success" document seems unique among the provinces thus far; it is a comprehensive, critical look at technology in schools in British Columbia which not only outlines relevant issues, but also makes strong recommendations for ways in which each of the issues can be resolved. Part of the reason this document is so unusual could be its origins: while the committees which made recommendations to the Ministry in 1995 included industry, business leaders and politicians, the 1999 recommendations were produced by a committee of practicing teachers, administrators and those politicians directly concerned with technology and education. Perhaps we are moving beyond Wilson's "first stage" of policy development.

Conclusions

As the few examples cited above demonstrate, policies and programs associated with the implementation of computer technologies in K-12 schooling in Canada are as wide-ranging as they are complex. Through our policy scan we have been able to identify an enormous range of

policy issues and policy development processes associated with the implementation of computers in schools, some of which are presented here.

Introducing computer technologies into the classroom has inter-related practical implications for staffing and human resource development, curriculum development, standards, budgets, and teacher training. In a time of declining public education budgets, important trade-offs are being made with little understanding of the short- and long-range consequences.

Indeed, not many schools, school districts or even provinces can even identify their total technology expenditures. These "expenditures" must be interpreted broadly, because expenses never end with the purchase of hardware and software, and continuing funds are always required for technical support, upgrades, maintenance and training. Only an awareness of the broad-ranging implications of technology acquisitions can lead to the development of sustainable strategies for implementation.

The introduction of technology inevitably raises questions about broader issues, such as the autonomy and working conditions of teachers, equitable access to resources, and the role of corporate interests in public schools. These are as much cultural questions as they are practical ones: who is in charge? Who teaches how, for whom, and why? What drives the agenda for education? Here, the involvement of teachers is crucial. Research has shown that teachers are generally supportive of using computers, but they are ambivalent about how spending priorities are made, unclear about how to make effective use of computers as teaching tools, and anxious for greater democracy in decisions about technology (Anjos, 1999; Apple, 1986; Apple & Jungck, 1998; Bryson & de Castell, 1998; Ham, 1997; Jenson, 1999; Ungerleider, 1997).

Is policy important? Policy helps determine the direction of change. It helps to determine the velocity of change. The way policies are developed encourages or discourages the buy-in of its participants and stakeholders. Ultimately, policies assure or discourage the sustainability of change.

Policy-makers and administrators at the school, school district and governmental levels have a decisive impact on the direction of any school reform (Glennan, 1998). Parents are also important: often the key driver for technology in the classrooms, parents need information to judge the educational "value" of different types of learning resources. They would ideally be part of the policy-making process. And in the classroom, teachers must be given the ultimate responsibility for determining the appropriate application of these tools. The overall picture we would paint is one of an enabling, supportive policy for experimentation coming from the top, with specific applications and innovation coming from the bottom.

Placing computers in schools is a deceptively easy task; dealing with the policy issues and the practical issues that accompany computers in the schools is less easy—and usually unanticipated by those who make decisions, especially when these decisions are not informed by research and experience.

We propose four recommendations for progressive policy development in this environment: the articulation of a plan or co-ordinating vision; the development of transparent policy processes; a

"value-added" approach to technological implementation, which relies upon research rather than hype; and a reward system acknowledging experimentation and innovation, with room to fail.

1. A co-ordinating vision is the first task of policy leadership. Provinces should have technology plans, with clear goals. Boards should have plans. Schools should have plans. And good planning should be rewarded with resources, up and down the chain.

2. A transparent and inclusive policy process. At each of these levels, managers needs to think carefully and consciously about the appropriate process for the development of policy. These processes need to be seen to be, and in fact must be, transparent and inclusive. They must locally appropriate—fit the institution and its history and culture.

3. A value-added approach to technology. Technology-enhanced learning must not be seen as a threatening alternative to the traditional and legitimate teaching, training, service and community functions of a school, but understood as a way to add value to each. Whatever we do, whatever decisions are made, have to be based on research results and growing body of experience we have about what works and doesn't work. In a decentralized educational system such as the Canadian one, this is not always easy.

4. Reward experimentation. We need a critical mass of examples of successful practice, at the local level. Good teachers teaching great courses, made better through new tools. Schools should encourage and legitimize innovation, create an environment which encourages risk-taking, and publicize it. The end result should be a critical mass of good examples, well publicized—as well as mistakes made and lessons learned (equally valuable).

A transparent and responsive policy practice combined with a value-added approach to technology will enable teachers to feel in control of these technologies, and encourage them to become innovators themselves, in their own attempts to fulfil the goals of their professional practice.

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